

SCRAMBLED CODE LETTERS FOR PROGRESS REPORT 56
Project 1108-17

Company - Mill	Machine No.	Code Letter
The Chesapeake Corporation - West Point	1	--
Continental Can Company, Inc. - Hopewell	1	F
Gaylord Container Corporation - Bogalusa	4	B
International Paper Company		
Bastrop	1	I
Bastrop	2	--
Georgetown	1	G
Georgetown	2	--
The Mead Corporation		
Sylva	1	P
Lynchburg	2	O
Harriman	1	Q
Knoxville	1	S
Muskingum Fibre Products Company - Coshocton	1	A
North Carolina Pulp Company - Plymouth	3	E
Olin Mathieson Chemical Corporation		
Monroe	1	--
Monroe	2	J
Owens-Illinois Glass Company		
Tomahawk	1	K
Tomahawk	2	N
Tomahawk	3	M
Big Island	1	H
Big Island	2	L
St. Joe Paper Company - Port St. Joe	1	C
Union Bag-Camp Paper Corporation - Savannah	2	D
West Virginia Pulp and Paper Company		
Covington	6	R
Covington	7	--
Charleston	8	--

THE INSTITUTE OF PAPER CHEMISTRY

Appleton, Wisconsin

SUPPLEMENTARY REPORT ON CALIPER OF SINGLE-FACED
BOARD

Project 1108-17

Progress Report 56

to

FOURDRINIER KRAFT BOARD INSTITUTE, INC.

December 1, 1959

THE INSTITUTE OF PAPER CHEMISTRY

Appleton, Wisconsin

This report is supplementary to Progress Report 55 of the baseline study on corrugating medium entitled, "Continuous evaluation of corrugating medium" which provides a program whereby participating mills have the opportunity to submit rolls of medium on a regular weekly schedule for evaluation with regard to physical characteristics of the medium and of the single-faced board made from the medium. Specifically, each medium is evaluated for caliper, basis weight, and Concora flat crush. In addition each medium is fabricated into A-flute single-faced corrugated board on the Institute's corrugator to determine its runability in terms of speed and tension, and the single-faced board obtained at maximum speed with minimum tension is evaluated for its flat crush strength.

This report is an extension of the baseline study described above and is concerned specifically with the caliper and uniformity of caliper of the single-faced board fabricated from each roll of medium. Uniformity of caliper is generally considered to be another facet of the criteria used to evaluate the runability of corrugating medium and the Technical Committee of the Fourdrinier Kraft Board Institute, Inc., has requested that a measurement of the uniformity of caliper be included as a part of the evaluation given each roll of corrugating medium.

The evaluation of the caliper and uniformity of caliper of the single-faced board made from each roll of corrugating medium was carried out using the five circular specimens that were subsequently tested for flat crush strength. Each specimen was five square inches in area. They were cut at intervals of approximately two feet along the central portion

of a strip of the single-faced board fabricated at maximum speed and minimum tension. On each of these five specimens, caliper measurements were made on five consecutive flutes and the caliper difference between consecutive flutes was calculated, there being four calculations of differences for each specimen. The twenty-five caliper measurements (five calipers on each of the five specimens) were averaged and are reported as the caliper for each sample of medium. Likewise, the twenty caliper differences between consecutive flutes (four caliper differences on each of the five specimens) were averaged, and the maximum, minimum, and average values are reported for each sample of corrugating medium.

The instrument for measuring the caliper of individual flutes of single-faced board consists of a bench-type thickness gage with a presser foot $3/8$ inch in diameter and an anvil consisting of a plane circular surface 2 inches in diameter. The presser foot is attached to a dial indicator which can be read to 0.0001 inch. The load on the presser foot is 100 ± 10 grams. A caliper determination is made by inserting each five-square-inch circular specimen between the presser foot and the anvil so that the foot rests on the second flute from one end of the specimen without touching either of the adjacent flutes. The $3/8$ -inch diameter of the presser foot permits it to contact only one flute with ease. The specimen is pressed gently against the anvil, and the reading is then recorded. As mentioned previously, five consecutive flutes through the center of each specimen are calipered in this way. It should be emphasized that these calipers may not necessarily correspond to regular caliper measurements because of differences in load and other variables.

Caliper data have been obtained on the single-faced board fabricated from each of the one hundred and four rolls of corrugating medium which were submitted for evaluation during the month of November. Also included for purposes of convenient reference are the single-face flat crush and runability data. The current machine averages for each test are summarized in Table I for Machines A through S. A graphical presentation of the caliper data on the single-faced board is shown in Figure 1, and a similar presentation of the data on the caliper difference between consecutive flutes is given in Figure 2. The test results obtained on the individual rolls of medium submitted by each company are given in Tables II through XX for Machines A through S, respectively.

It may be seen in Figure 1 and Table I that the average caliper results for the single-faced boards varied from a low value of 196.4 points for Machine K to a high value of 200.3 points for Machine J. Likewise, from the results given in Table I and Figure 2, it may be noted that the average caliper difference between consecutive flutes ranged from a minimum of 1.3 points for Machine K to a maximum of 3.9 points for Machine J. The majority of the machines were associated with average caliper differences of less than 2 points. The difference of 3.9 points associated with Machine J appears to be excessive.

TABLE I
SUMMARY OF CURRENT MACHINE AVERAGES
November, 1959

Machine	Number of Bolls	Caliper, points	Caliper Difference Between Consecutive Flutes, points	Single-Face Flat Crush, p.s.i.
A	9	199.1	2.4	31.3
B	9	197.6	2.3	30.9
C	4	196.8	2.8	29.2
D	10	198.2	2.0	32.0
E	7	197.5	1.7	36.5
F	12	198.5	1.5	31.9
G	10	196.8	1.5	35.4
H	6	197.4	1.7	33.1
I	7	198.0	1.7	34.7
J	3	200.3	3.9	37.9
K	1	196.4	1.3	31.6
L	6	197.6	1.6	31.5
M	1	197.7	1.7	36.5
N	1	197.6	2.6	32.9
O	6	198.0	1.5	31.7
P	4	199.9	2.1	30.8
Q	2	198.5	2.2	31.7
R	4	197.8	1.4	31.7
S	2	198.8	2.5	32.7
Total	104			

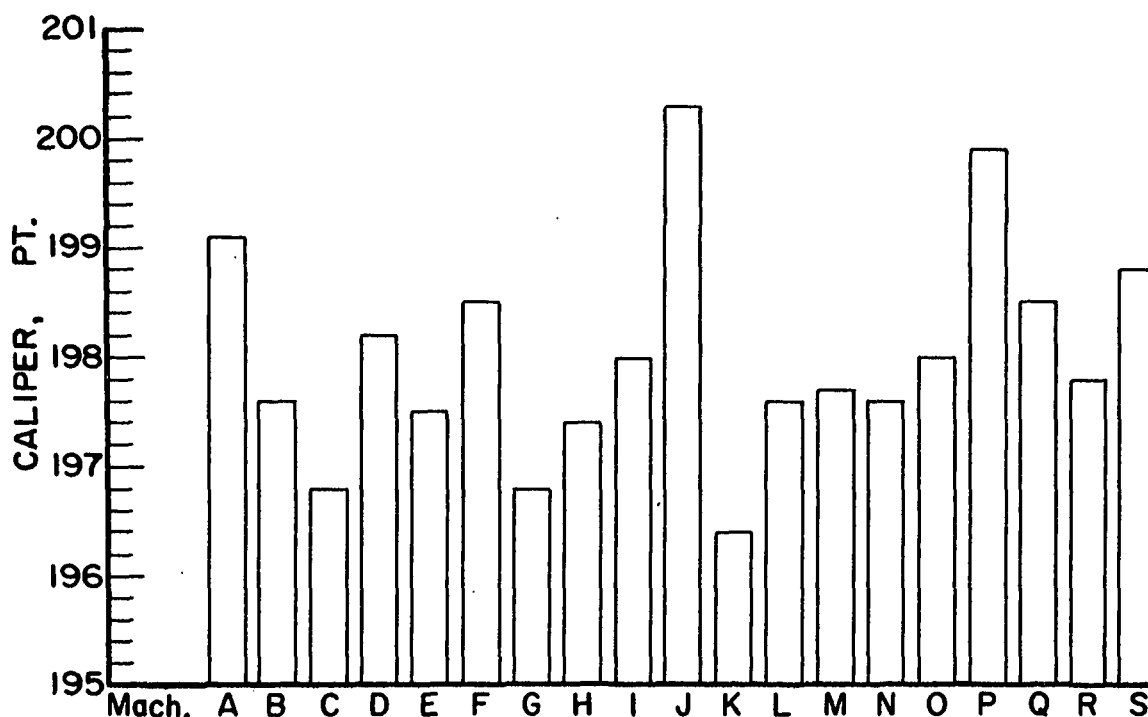


Figure 1

Comparison of Caliper Results on Single-Faced Board
November, 1959

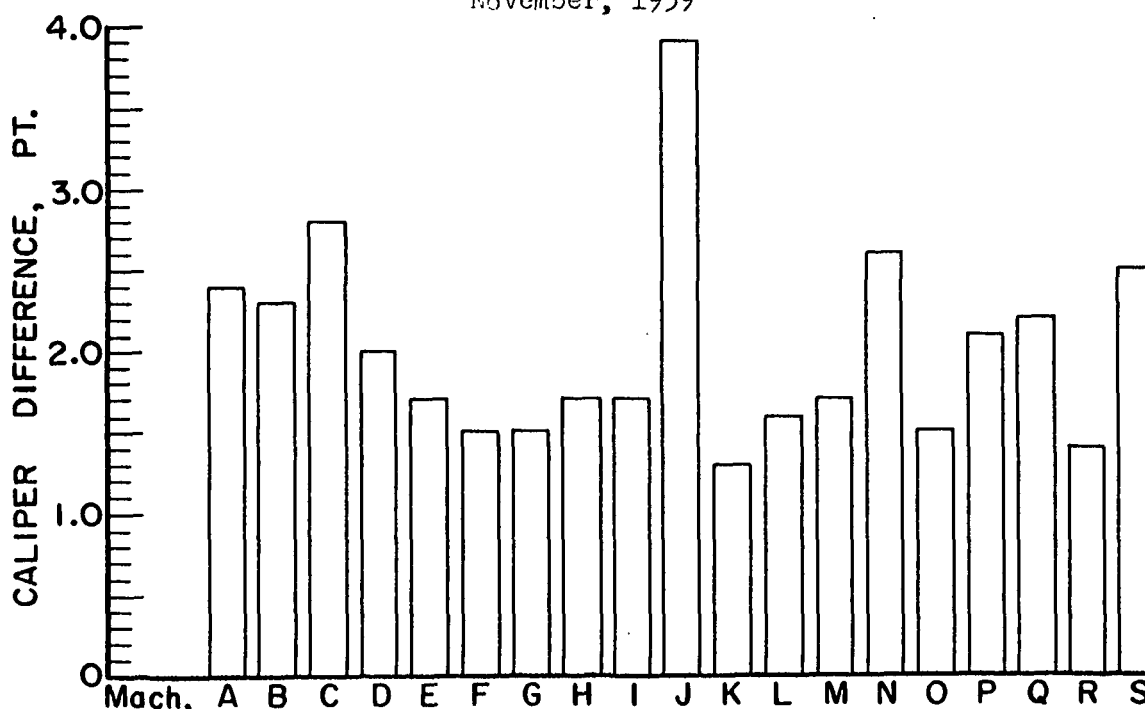


Figure 2

Comparison of the Caliper Differences Between Consecutive
Flutes of Single-Faced Board
November, 1959

TABLE II

SUMMARY OF TEST RESULTS FOR MACHINE A
November, 1959

Code	Date Made	Mill Roll No.	Caliper, pt.	Caliper Difference Between Consecutive Flutes, points			Single-Face Flat Crush, p.s.i.	Runability, (Maximum Tension at 600 f.p.m.), lb./in.
				Max.	Min.	Av.		
A-1	10-15-59	279	199.0	4.2	0.3	2.0	30.8	1-1/2
A-2	10-17-59	280	197.5	5.5	0.0	1.9	33.2	1
A-3	10-22-59	281	202.9	6.6	0.0	2.6	29.4	1-1/2
A-4	10-29-59	282	197.6	4.1	0.1	2.0	33.0	1
A-5	10-30-59	283	198.2	9.8	0.1	4.4	30.0	1/2
A-6	11- 4-59	284	200.1	7.2	0.0	2.4	30.9	1-1/2
A-7	11- 7-59	285	198.2	6.0	0.2	3.0	32.1	1-1/2
A-8	11-11-59	286	199.3	6.2	0.2	2.5	30.8	1-1/2
A-9	11-12-59	287	198.7	2.6	0.0	1.0	31.4	1-1/2
Current Machine Av. 199.1						2.4	31.3	

TABLE III

SUMMARY OF TEST RESULTS FOR MACHINE B
November, 1959

B-1	--	3	197.2	7.1	0.0	2.1	29.8	1
B-2	--	4	195.3	2.9	0.0	1.2	34.2	1-1/2
B-3	10-21-59	5	195.0	6.6	0.6	3.1	33.1	1-1/2
B-4	10-23-59	6	195.1	3.5	0.4	2.1	33.9	1
B-5	10-27-59	7	196.7	4.1	0.1	2.0	31.9	1
B-6	11- 2-59	8	199.6	6.4	0.0	2.7	30.6	1/2
B-7	11- 5-59	9	199.5	6.0	0.3	3.2	30.6	1
B-8	11- 9-59	10	200.1	5.6	0.8	2.5	26.9	1
B-9	11-11-59	11	199.8	6.6	0.1	2.2	27.0	1-1/2
Current Machine Av. 197.6						2.3	30.9	

TABLE IV

SUMMARY OF TEST RESULTS FOR MACHINE C
November, 1959

C-1	11- 5-59	39	196.4	8.5	0.3	3.2	30.7	Note a
C-2	11- 5-59	40	197.1	6.2	0.3	3.8	30.4	1/2
C-3	11- 7-59	41	197.2	4.3	0.2	1.7	27.2	1-1/2
C-4	11- 7-59	42	196.7	5.6	0.0	2.4	28.6	1-1/2
Current Machine Av. 196.8						2.8	29.2	

^a Maximum speed at minimum tension for this roll was 575 f.p.m.

TABLE V

SUMMARY OF TEST RESULTS FOR MACHINE D
November, 1959

Code	Date Made	Mill Roll No.	Caliper, pt.	Caliper Difference Between Consecutive Flutes, points			Single-Face Flat Crush, p.s.i.	Runability, (Maximum Tension at 600 f.p.m.), lb./in.
				Max.	Min.	Av.		
D-1	10-15-59	321	197.1	3.5	0.2	1.6	31.9	1-1/2
D-2	10-21-59	322	196.9	5.3	0.0	1.9	31.6	1-1/2
D-3	10-24-59	323	196.8	4.4	0.2	1.9	31.0	1-1/2
D-4	10-25-59	324	197.1	3.5	0.0	1.8	34.4	1-1/2
D-5	11- 1-59	325	199.1	5.3	0.1	1.6	32.4	1-1/2
D-6	11-11-59	327	199.4	5.7	0.5	3.3	31.4	1-1/2
D-7	11-14-59	328	198.8	7.2	0.1	2.5	31.6	1-1/2
D-8	11-15-59	329	198.1	4.5	0.1	2.1	33.0	1-1/2
D-9	11-15-59	330	198.9	2.5	0.0	1.2	30.8	1-1/2
D-10	11-16-59	331	199.8	4.7	0.1	2.0	32.0	1-1/2
Current Machine Av.			198.2			2.0	32.0	

TABLE VI

SUMMARY OF TEST RESULTS FOR MACHINE E
November, 1959

E-1	10- 7-59	195	195.6	3.0	0.0	1.1	36.0	1/2
E-2	10-12-59	322	196.9	4.2	0.0	1.1	38.0	1-1/2
E-3	10-15-59	405	198.5	3.7	0.1	1.3	34.5	1-1/2
E-4	10-23-59	618	197.0	2.9	0.1	1.3	41.9	1
E-5	10-28-59	738	198.5	4.7	0.1	2.4	31.0	1-1/2
E-6	10-29-59	780	197.9	4.9	0.1	1.9	39.6	1/2
E-7	11- 3-59	70	198.3	5.0	0.3	3.0	34.2	1
Current Machine Av.			197.5			1.7	36.5	

TABLE VII

SUMMARY OF TEST RESULTS FOR MACHINE F
November, 1959

F-1	10- 7-59	208	198.8	3.8	0.0	1.7	32.2	1-1/2
F-2	10- 9-59	209	197.8	5.7	0.1	1.8	31.4	1-1/2
F-3	10-15-59	210	198.2	3.1	0.0	1.3	29.3	1
F-4	10-17-59	211	197.9	3.5	0.6	1.7	29.6	1-1/2
F-5	10-19-59	212	198.8	4.1	0.1	1.3	30.8	1-1/2
F-6	10-22-59	213	198.6	3.8	0.2	1.6	32.4	1-1/2
F-7	10-25-59	214	198.1	3.1	0.1	1.3	31.9	1-1/2

(Continued on next page)

TABLE VII--CONTINUED

SUMMARY OF TEST RESULTS FOR MACHINE F--Continued
November, 1959

Code	Date Made	Mill Roll No.	Cali-per, pt.	Caliper Difference Between Consecutive Flutes, points			Single-Face Flat Crush, p.s.i.	Runability, (Maximum Tension at 600 f.p.m.), lb./in.
				Max.	Min.	Av.		
F-8	10-26-59	215	198.1	4.5	0.0	1.5	31.6	1-1/2
F-9	11- 3-59	216	199.3	5.5	0.0	1.6	34.3	1-1/2
F-10	11- 5-59	217	198.5	3.7	0.0	2.0	33.5	1-1/2
F-11	11- 9-59	219	199.0	3.9	0.0	1.3	32.1	1-1/2
F-12	11-12-59	220	198.9	3.6	0.0	1.2	33.9	1-1/2
Current Machine Av.			198.5			1.5	31.9	

TABLE VIII

SUMMARY OF TEST RESULTS FOR MACHINE G
November, 1959

G-1	10-13-59	354	197.4	4.4	0.3	1.9	35.8	1-1/2
G-2	10-15-59	355	195.5	4.4	0.1	1.5	37.4	1-1/2
G-3	10-21-59	356	195.6	3.1	0.1	1.3	35.4	1-1/2
G-4	10-24-59	357	195.6	3.1	0.2	1.3	35.2	1-1/2
G-5	10-27-59	358	196.8	2.6	0.0	1.2	35.4	1-1/2
G-6	10-29-59	359	197.0	6.6	0.1	2.1	34.9	1-1/2
G-7	11- 3-59	360	198.1	2.3	0.0	1.1	37.2	1-1/2
G-8	11- 8-59	361	197.8	3.5	0.2	1.5	33.6	1-1/2
G-9	11- 9-59	362	197.0	5.5	0.1	2.3	33.5	1-1/2
G-10	11-12-59	363	197.7	3.8	0.1	1.1	36.1	1-1/2
Current Machine Av.			196.8			1.5	35.4	

TABLE IX

SUMMARY OF TEST RESULTS FOR MACHINE H
November, 1959

H-1	10- 2-59	--	196.8	4.9	0.2	1.7	33.0	1-1/2
H-2	10- 6-59	445	197.4	4.4	0.5	1.9	32.9	1-1/2
H-3	10-11-59	796	197.5	3.1	0.0	1.3	32.4	1-1/2
H-4	10-12-59	900	196.9	3.3	0.1	1.9	34.2	1-1/2
H-5	10-15-59	1155	197.7	4.0	0.1	1.5	33.9	1-1/2
H-6	10-19-59	1389	197.9	3.3	0.2	1.8	32.3	1-1/2
Current Machine Av.			197.4			1.7	33.1	

TABLE X

SUMMARY OF TEST RESULTS FOR MACHINE I
November, 1959

Code	Date Made	Mill Roll No.	Caliper, pt.	Caliper Difference Between Consecutive Flutes, points			Single-Face Flat Crush, p.s.i.	Runability, (Maximum Tension at 600 f.p.m.), lb./in.
				Max.	Min.	Av.		
I-1	10-21-59	515	197.6	6.0	0.1	1.7	34.6	1-1/2
I-2	10-27-59	516	198.4	3.9	0.5	2.2	32.7	1-1/2
I-3	11- 3-59	517	197.0	3.0	0.2	1.4	36.6	1-1/2
I-4	11- 6-59	518	197.1	3.1	0.1	1.4	34.7	1-1/2
I-5	11-13-59	519	198.4	3.9	0.1	1.8	33.0	1-1/2
I-6	11-18-59	520	198.4	3.5	0.1	1.8	35.3	1-1/2
I-7	11-20-59	521	199.2	4.9	0.0	1.7	35.9	1-1/2
Current Machine Av.			198.0			1.7	34.7	

TABLE XI

SUMMARY OF TEST RESULTS FOR MACHINE J
November, 1959

J-1	10-10-59	178	199.7	9.9	0.5	4.1	39.4	Note a
J-2	10-15-59	179	204.4	7.8	0.6	3.0	38.4	Note b
J-3	10-16-59	180	196.9	9.1	0.8	4.7	36.0	Min.
Current Machine Av.			200.3			3.9	37.9	

^a Maximum speed at minimum tension for this roll was 500 f.p.m.

^b Maximum speed at minimum tension for this roll was 575 f.p.m.

TABLE XII

SUMMARY OF TEST RESULTS FOR MACHINE K
November, 1959

K-1	10-27-59	--	196.4	2.6	0.0	1.3	31.6	1
Current Machine Av.			196.4			1.3	31.6	

TABLE XIII

SUMMARY OF TEST RESULTS FOR MACHINE L
November, 1959

Code	Date Made	Mill Roll No.	Caliper, pt.	Caliper Difference Between Consecutive Flutes, points			Single-Face Flat Crush, p.s.i.	Runability, (Maximum Tension at 600 f.p.m.), lb./in.
				Max.	Min.	Avg.		
L-1	9-30-59	2374	197.8	4.5	0.2	1.8	29.7	1-1/2
L-2	10- 4-59	214	196.9	4.8	0.0	1.9	30.8	1-1/2
L-3	10-10-59	755	196.4	4.1	0.1	1.5	31.1	1-1/2
L-4	10-14-59	1041	198.4	4.1	0.2	2.1	35.0	1-1/2
L-5	10-18-59	1399	198.6	2.6	0.0	1.3	31.2	1-1/2
L-6	10-22-59	1712	197.3	3.0	0.0	1.3	31.4	1-1/2
Current Machine Av.			197.6			1.6	31.5	

TABLE XIV

SUMMARY OF TEST RESULTS FOR MACHINE M
November, 1959

M-1	10-29-59	--	197.7	4.8	0.2	1.7	36.5	1-1/2
Current Machine Av.			197.7			1.7	36.5	

TABLE XV

SUMMARY OF TEST RESULTS FOR MACHINE N
November, 1959

N-1	10-28-59	--	197.6	6.3	0.0	2.6	32.9	1
Current Machine Av.			197.6			2.6	32.9	

TABLE XVI

SUMMARY OF TEST RESULTS FOR MACHINE O
November, 1959

O-1	10-20-59	187	196.7	2.2	0.1	1.1	32.8	1-1/2
O-2	10-20-59	188	197.8	5.4	0.2	1.6	31.2	1-1/2
O-3	10-20-59	193	198.1	5.3	0.2	1.6	30.5	1-1/2
O-4	10-20-59	194	197.4	4.0	0.1	1.2	31.5	1-1/2
O-5	11-13-59	205	198.8	3.7	0.1	1.6	32.5	1-1/2
O-6	11-13-59	206	199.3	6.6	0.1	1.7	31.5	1-1/2
Current Machine Av.			198.0			1.5	31.7	

TABLE XVII

SUMMARY OF TEST RESULTS FOR MACHINE P
November, 1959

Code	Date Made	Mill Roll No.	Caliper, pt.	Caliper Difference Between Consecutive Flutes, points			Single-Face Flat Crush, p.s.i.	Runability, (Maximum Tension at 600 f.p.m.), lb./in.
				Max.	Min.	Av.		
P-1	10-28-59	193	200.3	4.0	0.0	1.7	31.2	1-1/2
P-2	10-29-59	194	200.0	5.2	0.1	2.1	27.4	1/2
P-3	11-12-59	205	199.2	5.3	0.0	2.4	31.9	1-1/2
P-4	11-12-59	206	200.2	5.3	0.0	2.3	32.8	1-1/2
Current Machine Av.			199.9			2.1	30.8	

TABLE XVIII

SUMMARY OF TEST RESULTS FOR MACHINE Q
November, 1959

Q-1	11- 5-59	201	198.0	4.6	0.0	2.0	33.4	1-1/2
Q-2	11- 5-59	202	199.0	4.5	0.9	2.5	30.0	1-1/2
Current Machine Av.			198.5			2.2	31.7	

TABLE XIX

SUMMARY OF TEST RESULTS FOR MACHINE R
November, 1959

R-1	9-24-59	41	196.1	4.4	0.1	1.4	32.8	1/2
R-2	10- 9-59	42	197.4	4.5	0.0	2.0	32.6	1
R-3	10-15-59	43	199.0	4.5	0.0	1.2	31.6	1
R-4	10-21-59	44	198.9	3.7	0.1	1.2	30.0	1-1/2
Current Machine Av.			197.8			1.4	31.7	

TABLE XX

SUMMARY OF TEST RESULTS FOR MACHINE S
November, 1959

S-1	11- 5-59	203	198.5	4.7	0.0	2.0	33.5	1-1/2
S-2	11- 5-59	204	199.0	6.3	0.5	3.0	31.9	1-1/2
Current Machine Av.			198.8			2.5	32.7	

THE INSTITUTE OF PAPER CHEMISTRY

W. N. Hubert

W. N. Hubert, Research Aide
Container Section

R. C. McKee

R. C. McKee, Chief, Container Section